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Chal - 0107
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12 May 1958

MEMORANDUM TO OPERATIONS

SUBJECT: Personal Equipment. Staff Visit to Exhalation Valve Manufacturer.

1. Purpose of Trip: To determine the cause of exhalation valve diaphragm ruptures experienced at EAFB and to familiarize the valve manufacturer (Hawks Sierra Madre, California) with these problems and seek solutions.

2. Prior to visiting the Hawk's Company, a stopover was made at EAFB to absorb a full understanding of the valve difficulties and to pick up the valves for hand carry to the manufacturer. There were also other interests in line with Personal Equipment necessitating a visit to EAFB. These interests will be discussed in the closing paragraphs.

3. Problem: WRSP IV at EAFB was the first project unit to receive the new silicone diaphragmed MSV 28A-137 exhalation valves. Of the first 8 received, 3 were reported to have counterpressure tubes of a length shorter than minimum specified and the remaining balance of 5 reportedly ruptured at 120 MM Hg pressure.

Inspection of the manufacturers testing procedures revealed that each valve destined for project use was tested separately for vacuum and pressure readings to as much as 100% above what is required by specifications. In testing for the diaphragm rupture point, of the several ruptured in the interest of our satisfaction, the minimum rupture point observed was 28PSI or 1,447.6 Hg. Top valve for rupture was 40PSI or 2,068.0 MM Hg. Considering our requirement for a diaphragm capable of repeated exposures to 150 MM Hg, it becomes obvious that even the weakest of the diaphragms to be impressively favorable.

It has been expressed by some of the field units that prescribed pre-flight testing of the exhalation valve to 150 MM Hg to be a strain on the diaphragm and conducive to in-flight malfunctions. The manufacturer has assured us that there is no validity to this assumption and further recommends continuance of the pre-flight test.

Of the 5 diaphragms reported by WRSP IV as ruptured, one was tested and found not to be ruptured. A leak in the valve housing or counterbalance tube resulting from improper installation of the valve in the face piece provided the same indication as a ruptured diaphragm. The Hawk's Corp. will test all of the reported ruptured diaphragms and present their findings to headquarters.

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The manufacturer has been asked to pre-bend the counterbalance tubes so as to preclude leaks created when shaped by field technicians. Furthermore, the manufacturer has been advised to utilize a more flexible sealant in the valve housing and counterpressure tube connection to prevent leaks that otherwise may be caused in a brittle sealant by final forming and installation efforts in the field.

Because the exhalation valve is of the "fail unsafe" type with no possibility for redesign for "fail safe", the manufacturer has been asked to engineer facilities for mechanical closing in event of flight malfunctions. The suggestions provided to them will be worked into this endeavor and headquarters will be provided with the first prototype emergency manual close valve as it becomes available. The problem of improperly dimensioned counterpressure tubes has been solved. It remains for the project to return all those on hand to the depot for exchange with the manufacturer.

Conclusions and Recommendations:

The present MSV 28A-137 exhalation valve is completely adequate for our present requirements. The reported failures due to diaphragm rupture under pressure conditions of 120 MM Hg.were but housing and counterpressure tube leaks created in the process of valve installation. A message outlining installation procedures will be distributed to the field. The testing and quality control measures adhered to by the manufacturer are well within the conformity required. The valves will continue to be distributed to the field units and all previous pre-flight and routine inspections and maintenance checks will be continued. The engineering of a "manual close" emergency feature on the exhalation valve is considered desireable. We in the project know of 3 instances when our pilots have suffered hypoxia as a result of malfunctioning exhalations valves. Presently there is no in-flight remedial action. The manual close valve offers remedial action permitting peak altitude holding and other than emergency descent rates in the event of mal-function. It is recommended that official approval be granted for the design and construction of a prototype valve with this feature.

4. Other Business: Emergency Aircraft and Seat Pack Oxygen System. The emergency oxygen system designed through the joint efforts of the WRSP IV pilots and P.E. section personnel with the assistance of [redacted] of LAC submitted to Hq in March 1958 was not acceptable at the time of submission. On 7 May 1958 [redacted] contacted me with information that all the shortcomings pointed out in the March 58 system had been solved and that by mid May a mock up of the new system would be available for study at LAC., [redacted] has been asked to submit photographs and a written report on the new emergency oxygen system. Recommendations will be withheld sending analysis of the new system information.

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5. Helmet Bladder Deterioration: The new helmet bladders reported by WRSP IV as weakened and deteriorated at time of unpackaging were inspected and found unacceptable. These bladders (all of same cure date) are being returned to the manufacturer. (Playtex Co. of Dover, Delaware) Field units have been cautioned about these bladders. Obeyance of pre-installation and pre-flight inspections negate the possibility of using the unacceptable type for flights. Suspicions of bladder deterioration due to improper storage has led to a depot visit by the WRSP IV Physiologist to inspect rubber storage conditions and offer assistance as needed. The Physiologist has been thoroughly familiarized with the ideal rubber storage environment of 72° F temperature, less than 5% humidity and in absence of sunlight and oil.

6. Oxygen Regulator IRAN: In order to expedite the IRAN program for project regulators, [redacted] of LAC has offered to bring six of FOG'S spare oxygen regulators into play. The six spare regulators are in the possession of LAC. This will result in a time gain for the project at no expense to FOG.

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7. Helmet Bladders ... New Material: The life period for both latex and neoprene bladder seals has been ranging between 4 to 18 months. A new vynil plastic material capable of maintaining flexibility in - 90° F temperatures and resistant to tearing has recently been developed by the McClin Company of Los Angeles, California. It is suspected that if adaptable to helmet bladders that this non deteriorating material would have an indefinite life expectancy in pressure helmet intergration. There is also a possibility of using silicone for helmet bladder seals. Both these materials will be brought to the attention of the prime contractor for helmets.

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Aviation Physiologist

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